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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/941,595	08/30/2001	Takeo Tsukamoto	35.C15726	6437

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EXAMINER	
HODGES, MATTHEW P	

ART UNIT	PAPER NUMBER
2879	

DATE MAILED: 05/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/941,595	TSUKAMOTO, TAKEO	
	Examiner	Art Unit	
	Matt P Hodges	2879	

-- Th MAILING DATE of this communication app ars on th cov r sheet with the correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) *28-35* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 March 2004* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/8/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

The Amendment, filed on 3/8/2004, has been entered and acknowledged by the Examiner.

Drawings

The drawings were received on 3/8/2004. These drawings have been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-8 and 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (US 5,973,444) in view of Den et al. (US 6,628,053).

Regarding claims 1-8 and 22-25, Xu discloses an electron-emitting device including carbon fibers and a catalyst of palladium for growing the carbon fibers. (Column 9 line 65 – Column 10 line 25) (Column 7 lines 52-59) (Column 5 lines 19-23). The fibers are more than 90% carbon (Column 9 lines 29-31). The fiber includes portions of the catalyst. (Column 9 lines 32-37). Here the catalyst is disposed on the substrate or alternatively on a growth surface on top of the substrate. (Column 6 lines 7-10). This growth surface can be a semiconductor or a dielectric. Further the fibers can include single wall (nanotubes), multiple-walled (nanotubes

with graphens layered in an axial direction with respect to the fiber), or vermicular fibers (nanofibers). (Column 9 lines 40-46). Xu does not appear to specify the use of Ti as the component of the oxide semiconductor growth surface, However Den in the same field of endeavor discloses the use of Titanium and Titanium Oxide as a growth structure for a carbon nanotubes. Specifically Den discloses the use of a titanium conductor (21) and titanium oxide (22) formed in the process of creating the growth sites that are combined in the semiconductor layer (25) of Figure 5a-5c. (Column 7 lines 30-60). The use of the semiconductor wells as a carbon nanotubes growth site advantageously controls the diameter and direction of the carbon nanotubes thus improving the device characteristics such as emitance conformity in the final product. Further the semiconductor wells allow for directed attachment of the tubes to the electrodes. (Column 4 lines 35-43). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to the use of semiconductor Titanium and Titanium Oxide as a growth structure for a carbon nanotubes as disclosed by Den into the device as taught by Xu in order to beneficially control the diameter and direction of the carbon nanotubes thus improving the device characteristics such as emitance conformity in the final product.

Claims 9, 10, 13-15, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamanobe et al. (US 5,847,495) in view of Xu et al. (US 5,973,444) and further in view of Den et al. (US 6,628,053).

Regarding claims 9 and 10, Yamanobe discloses (see figure 1b) an electron-emitting device including a first electrode (5), second electrode (4) spaced apart from the first electrode,

and a means for applying voltages to the two electrodes. The first electrode is larger than the second electrode. Further Yamanobe discloses a layer of fine conductive particles partially on the first electrode to the left of the gap (2) electrically separating the two electrodes. (Column 9 lines 1-8) (Column 10 lines 20-27). Yamanobe does not appear to specify the use of carbon nanofibers grown on Pd catalyst over an Aluminum oxide layer as the emitting film. However Xu, in the same field of endeavor, discloses the use of carbon fibers grown on a conductive cathode in the manner described in the rejection of claim 1 above in order to advantageously provide small emitter tips, increased emission uniformity, and reduced manufacturing cost (the latter with respect to carbon fibers not grown on a catalyst as disclosed). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the use of carbon fibers grown on a conductive cathode as described by Xu into the electron emitting device as disclosed by Yamanobe in order to advantageously provide small emitter tips, increased emission uniformity, and reduced manufacturing cost.

Yamanobe in view of Xu as described above does not appear to specify the use of Ti as the component of the oxide semiconductor growth surface, However Den in the same field of endeavor discloses the use of Titanium and Titanium Oxide as a growth structure for a carbon nanotubes. Specifically Den discloses the use of a titanium conductor (21) and titanium oxide (22) formed in the process of creating the growth sites that are combined in the semiconductor layer (25) of Figure 5a-5c. (Column 7 lines 30-60). The use of the semiconductor wells as a carbon nanotubes growth site advantageously controls the diameter and direction of the carbon nanotubes thus improving the device characteristics such as emitance conformity in the final product. Further the semiconductor wells allow for directed attachment of the tubes to the

electrodes. (Column 4 lines 35-43). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to the use of semiconductor Titanium and Titanium Oxide as a growth structure for a carbon nanotubes as disclosed by Den into the device as taught by Yamanobe in view of Xu in order to beneficially control the diameter and direction of the carbon nanotubes thus improving the device characteristics such as emitance conformity in the final product.

The recitation of a higher voltage on the second electrode than applied to the first electrode has not been given patentable weight because is considered an intended used recitation. It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations.

Regarding claims 13-15 and 26-27, Yamanobe further discloses the use of the aforementioned electron-emitting devices in a display device (see figure 58). Here the display further comprises an anode (115) and a phosphor film (114) formed on the anode. (Column 55 lines 59-67).

Claims 11, 12, 16-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamanobe et al. (US 5,847,495) in view of Xu et al. (US 5,973,444) in view of Den et al. (US 6,628,053) and further in view of Yoshioka et al. (5,066,883).

Regarding claims 11 and 12, Yamanobe further discloses (see figure 35ac) the alternative use of a step portion 21 under the first electrode to raise the electrode higher than the second electrode. (Column 48 lines 1-9). Yamanobe does not appear to disclose the step portion being

integral with the substrate however Yoshioka, in the same field of endeavor, discloses (see figure 7) the use of directing etching the substrate in order to create the step portion and raise the first electrode. (Column 5 lines 54-59). This direct etching advantageously eliminates the need for several manufacturing steps and thus decreases manufacturing cost. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the step portion being integral with the substrate as described by Yoshioka into the electron emitting device as disclosed by Yamanobe in view of Xu and further in view of Den in order to advantageously eliminates the need for several manufacturing steps and thus decreases manufacturing cost.

Regarding claims 16-18, the ends of the plurality of fibers are higher off of the substrate than the second electrode.

Regarding claims 20 and 21, Yamanobe further discloses the use of the aforementioned electron-emitting devices in a display device (see figure 58). Here the display further comprises an anode (115) and a phosphor film (114) formed on the anode. (Column 55 lines 59-67). Each electron-emitting portion is independently addressable thus forming an image display device.

Regarding claim 19, Yamanobe in view of Xu in view of Den and further in view of Yoshioka discloses all the claimed elements but does not appear to specify the use of a first electrode that is larger in thickness than the second electrode while also having the ends of the fibers arranged above the second electrode. However the use of a larger electrode in combination with the substrate step portions allows for smaller etchings in the substrate while still allowing for the same overall first electrode height. The ability to have smaller surface etchings in the substrate advantageously allows for a greater ease of manufacture. Thus, it would

have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate larger electrode into the electron emitting device as disclosed by Yamanobe in view of Xu in view of Den and further in view of Yoshioka in order to advantageously allow for a greater ease of manufacture.

Response to Arguments

Applicant's arguments with respect to claims 1-27, specifically related to there not being Titanium Oxide in the semiconductor layer, have been considered but are moot in view of the new ground(s) of rejection.

Regarding applicants claim that Den does not teach the use of a metal-oxide semiconductor examiner respectfully disagrees. Den discloses the use of several metal oxide semiconductor structures including the semiconductors of figures 5C and 5D. Den teaches the use of combining the wall and conductive layer into a semiconductive layer and cites a specific example later of creating such a pattern with a silicon substrate. (Column 20 lines 55-65) and example 3 (Column 17 line 47 – Column 18 line 55).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Saito (US 6,455,021) discloses the use of carbon nanotubes grown on catalyst including Pd.

Chen et al. (US 6,471,936) discloses the use of carbon graphenes in a variety of forms.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matt P Hodges whose telephone number is (571) 272-2454. The examiner can normally be reached on 7:30 AM to 4:00 PM M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel can be reached on (571) 272-2457. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7382 for regular communications and (703) 308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Joseph Williams

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